ESTIMATING THE MARKET POTENTIAL FOR COMMERCIAL FEEDS IN THE EASTERN THIRD OF KANSAS

by

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PART I. BASICS OF MARKET POTENTIALS

CHAPTER I

Introduction

The Commercial Feed Industry.--Commercial feed is produced by feed manufacturing firms for the large and changing market of American agriculture. Some of this change is apparent in farming which is becoming more specialized particularly in certain geographic locations. The specialized dairy operations of Wisconsin and the equally specialized broiler operations of northwestern Arkansas are two examples of significant changes in agriculture.

Changes in agriculture are necessarily of great importance to firms manufacturing commercial feed. Purchase of commercial feed is almost wholly by the livestock sector of the agricultural industry. Thus, it is of great importance that feed firms have a means of measuring these changes. Market potential estimates have been used by firms marketing industrial goods for many years and some of these methods are being utilized by firms manufacturing commercial feed.

For the most part, market potential studies are new to the commercial feed industry. One of the big handicaps has been the lack of basic data pertaining to the industry, and of data of sufficient detail on livestock numbers and feeding rates as well as satisfactory techniques to measure them. In the early days of the commercial feed manufacturing industry, orders alone determined the amount of feed that

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was produced.[1] However, after the turn of the century, changes in merchandising, feeding techniques, plant size and location, along with the changes in agriculture, greatly altered the older ordering method in determining the kind and amount of feed to be produced.

Market potential research provides a method whereby feed manufacturing firms can make reasonably accurate estimates of the amount of commercial feed that will be used. However, some research on data available is necessary to evaluate the different procedures that are available. It is of major importance to the firms to know what the market potential is due to its importance in managerial decision-making.

When management has this tool, it is able to run the business more profitably. There is then a solid base for decision-making on such items as plant location, size of sales force, space, and number of employees.

Kansas is an important agricultural state and ranks high in livestock numbers. The measure of potential sales of commercial feed to this market can be accomplished to show the present state of the arts in market potential studies. In a sense, Kansas provides an excellent laboratory for experimenting with different techniques in order to answer the unknowns such as the number of consuming units and the feeding rates.

Basically, the equation involves two easily defined variables--

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[1] Feed Production Handbook 1st ed. (Kansas City: Feed Production School, 1961), p. 7.

the number of animals and, the average amount of commercial feed farmers are feeding. If these two variables are known, the problem is simply one of multiplication. However, it is not that easy since there are many different classes of beef cattle such as calves, steers, and bulls, plus the different types of feeding programs these beef cattle may be under. The second and most crucial lack, is the almost negligible data on feeding rates of commercial feed.

With these problems in mind, it was necessary to look for a class of livestock which was reasonably homogeneous in its use of feed and for which some data was available on the feeding rates of commercial feeds. Hence, dairy cows were selected since this class of livestock meets both of the criteria.

Procedures Used to Estimate the Market Potential.--The basic method which was mentioned earlier involved multiplying the number of dairy cows in any given area by the average feeding rate for commercial feeds. In this paper, three variations of this basic method are used in order to fit the three sources of data available. For lack of a better term, these variations will be called procedures.

These three procedures are developed from the simplest to the more complex. The first procedure utilizes data on milk cow numbers multiplied by a published average feeding rate of commercial feed per animal to arrive at the total amount of commercial feed fed. The second procedure was developed by finding as many experts' opinions on concentrate feeding rates as possible and computing an average of these rates. To this average, was applied a published percent of commercial feed in the milk cow ration as well as a level from the survey of Kansas dairy farmers. The third procedure was to survey farmers having dairy cows and to determine the feeding rate that they reported. The average feeding rate of commercial feed was applied to the average number of milk cows.

Projection of tonnage of commercial feed was done for each procedure to the year 1970. Levels of commercial feeding rates were available for the first procedure for the seven years, 1956 to 1962. Levels were computed for the remaining two procedures for years other than 1962 based on the level of change in the first procedure.

Definitions.--There are several terms used in this study which required careful definition in order to include precisely the correct results. These terms are organized under two main headings which are: market terms and feed terms.

Market Terms.--The first of the market terms is milk cows. Milk cows as used in this paper refers to cows kept for milk production for human consumption or milk produced for some other commercial use. These cows would be of such an age as to have reached lactation or to have been in lactation.

The second marketing term is market potential. There are numerous definitions for this term and a thorough discussion of definitions can be found in Hummel.[2] For the purpose of this study, market potential is defined as the relative strength of a market to absorb commercial feeds for a particular area.[3] Generally, market potential for commercial feeds is the total amount of commercial feed which all manufacturers can expect to sell in the specific area in question.

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[2] Francis E. Hummel, Market and Sales Potential (New York: The Ronald Press Company, 1961), p. 6.

Feed Terms.--There are two basic terms for definition under this heading. The first of the two terms is concentrate. Concentrates are one of the two main types of feed for livestock; the other broad classification being roughages. The differentiation between concentrates and roughages is made on the basis of fiber content and the amount of total digestible nutrients which the feed furnishes. On this basis, concentrates are easily distinguished as they are low in fiber content and high in total digestible nutrients.[4] Thus, concentrates would include all feed grains, protein supplements, millfeeds, and by-product feeds as well as commercial feeds.

Commercial feeds comprise a part of the concentrate classification. The distinguishing point is that commercial feeds have been mechanically altered and usually involve the mixing of two or more ingredients from two or more sources. Corn grain that has been mechanically altered would not be a commercial feed, but if another ingredient, such as soybean meal, were added it would be classified as a commercial feed. Defining commercial feeds has exposed differing opinions and several good references are available.[5]

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[3] Ibid., p. 1.

[4] Frank B. Morrison, Feeds and Feeding (Ithaca: The Morrison Publishing Company, 1956), p. 15.

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[5] *Ibid.*, p. 15; *Feed Production Handbook*, p. 23; and H. J. Fisher, *Commercial Feeding Stuffs*, Connecticut Agricultural Experiment Station Bulletin No. 645 (New Haven: July, 1961), p. 3.

CHAPTER II

Collecting the Data

Introduction.--Three separate sources of data were utilized to obtain information aforementioned for the three procedures. The first procedure was supported entirely by data published by the Statistical Reporting Service of the U. S. Department of Agriculture. This series of data provided estimates of the feeding rates of commercial feed for the years 1956 through 1962.

Data for the second procedure was obtained from three sources. The first source was a compiling of experts' opinions plus survey results on the average feeding rate of concentrate to milk cows. In order to arrive at the average amount of commercial feed fed, the percentage figures used in Procedure I and those obtained from the sample survey of farmers reporting milk cows, were utilized.

The third procedure utilized the data from a survey of dairy farms. This sample was designed to obtain information on three things; (1) percent of farmers feeding commercial feed to milk cows; (2) average amount of commercial feed fed to milk cows; and, (3) the percentage of commercial feed in the total concentrate ration. No attempt was made to estimate the number of milk cows from the returned questionnaires.

Organization of the Survey.--The organization of the survey was undertaken in three ordered steps: (1) designation of kinds of livestock and poultry; (2) determination of the area to be sampled; and, (3) the actual drawing of the sample. The survey was taken for the feeding rates of most all farm animals, but for the purposes of this paper, only the information on milk cows was used. An example of the questionnaire is shown on pages 10 and 11.

Sample Frame.--The sample frame consisted of the names of 69,889 livestock farmers as reported in the County Assessors Record books. These books are edited by the Kansas Crop Reporting Service and stored in their files. A livestock farm was defined as a farm having either hogs or cattle or both species.

Area of the State.--The state of Kansas is divided into nine crop reporting districts as shown on page 12. This study is concerned with district 3, 6, and 9 or approximately the eastern third of the state.

The Sample.--A systematic random sample was used as the method of selecting names from the Township Assessor Record books for the general livestock sample which included milk cows.[6] The 1962 books were used since they were the most recent available.

Operationally, the names were selected by taking every fourteenth name from a random start. The Township Assessor Record books were arranged in alphabetical order by counties in each crop reporting district and each county. A random start was made at the beginning of each crop reporting district.

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[6] George W. Snedecor, Statistical Methods (5th ed.; Ames: The Iowa State University Press, 1961), p. 493.

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1. Number of acres you operated in 1962____________________.

2. Age of operator (check one): 20-30____ 30-40____ 40-50____ Over 50

3. Livestock information for 1962. Please fill in spaces that apply to your farm.

Kind of livestock	Total number	Days fed grain or concentrate	Total grain and concentrate fed to livestock		Of total, how much was purchased commercial feed	
			Per animal (use either lbs.	Total column) lbs.	Per animal (use either lbs.	Total column) lbs.
1) Milk cows						
2) Stock cows						
3) Other rough-fed cattle & calves						
4) Cattle & calves fattened on grain						
5) Hogs fattened for market						
6) Hogs for breeding stock						
7) Laying hens						
8) Other chickens						

4. Origin of grain and other concentrates fed in 1962.

	Grain home grown	Grain purchased from other sources	Commercial feed purchased	
			Bag	Bulk
Amount in tons				

5. Commercial feed purchases

Commercial feed purchases	1962	Expected in 1963
1) Protein supplement, tons		
2) Mixed complete feeds, tons		

6. How many brands of feed did you use last year?__________________________

7. How often do you change feed dealers?___________________________________

8. Do you use a grain bank? (where you deliver grain to the elevator and manufactured feed is delivered to you) Yes_______ No_______

9. What brand of feed is advertised most in your area?______________________

Definitions

Commercial feed--includes manufactured feeds but not unmixed grain such as ground corn.

Concentrates--includes all feed grains, protein supplements, millfeeds, and by-product feeds as well as commercial feeds.

Figure 1.--Sample Questionnaire

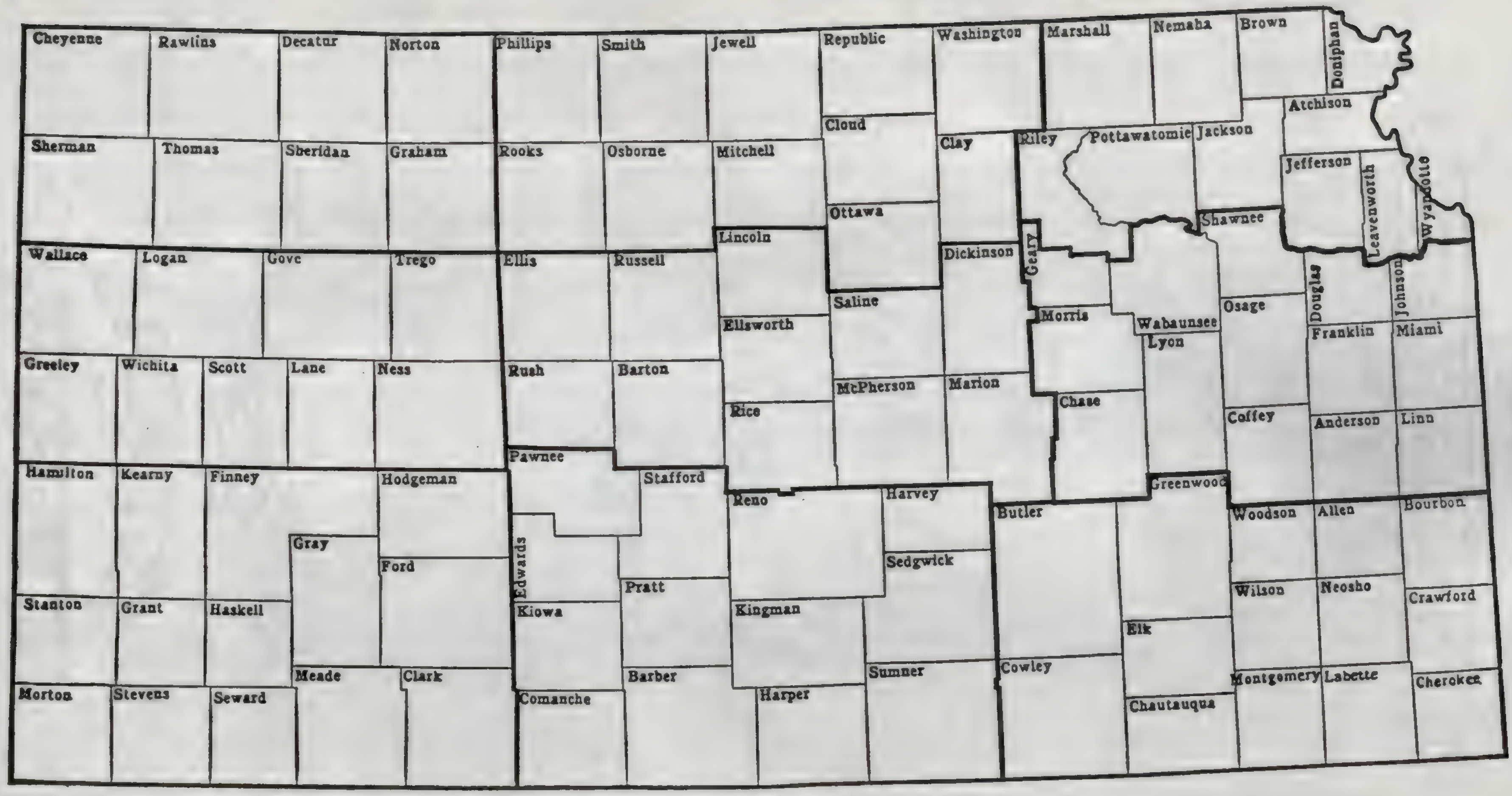

Figure 2.--Kansas Map Showing Crop Reporting Districts.

A list of extreme operators was obtained from the Kansas Crop Reporting Service. At that time, there was only one dairy farm so classified. However, the return from this operator stated that he had a beef cow operation and not a dairy operation.

Sampling Response.--A total of 4,919 questionnaires were mailed to livestock farmers. Of this total 586 useable questionnaires were returned giving a 12 percent reply. No attempt was made for a second request or a non-response interview.

It is not possible to determine exactly how many milk cow farms were sampled in the eastern third of Kansas. However, the method used in drawing the sample should have allowed for approximately the correct number of dairy cow farms to be included in the sample. Assuming this was the case, approximately 50 percent of the names drawn or 1,150 farmers should have had milk cows of some kind. The 50 percent figure is based on the number of milk cow farms compared with the number of livestock farms.

Sixty-four questionnaires were returned which showed milk cows on farms during 1962. This would give a return of about 5.6 percent of the milk cow farms sampled. This return would represent only about .4 percent of the population sampled.

PART II. PROCEDURES USED TO ESTIMATE MARKET POTENTIALS

CHAPTER III

Procedure I

Introduction.--Procedure I was the simplest to compute by virtue of the fact that the data available was in detail and did not have to be calculated.

Explanation of the Data Used.--The data used in this procedure was the simplest because basic information was available for each of the seven years, 1956-1962. Data on feeding rates of concentrates per cow was given in the *Agricultural Statistics* for each year.[7] This publication gave a figure on the percentage of commercial feed in the concentrate ration. The average pounds of commercial feed fed per milk cow can be computed by applying the percentage figure times the pounds of concentrate.

The average number of milk cows for the eastern third of Kansas was taken from the *Kansas Farm Facts* publication.[8] This series of data gives the average number of milk cows on farms over a calendar year period and is not an inventory number for any specific point in time.

Explanation of the Procedure.--This procedure involves three steps:

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[7] United States Department of Agriculture, *Agricultural Statistics* (Washington: U. S. Government Printing Office, 1957-1963).

[8] Kansas State Board of Agriculture, *Kansas Farm Facts* (Topeka: State Printer, 1957-1963).

(1) determination of the average pounds of concentrates fed per milk cow; (2) multiplication of the percent of commercial feed by the average pounds of concentrate to derive the average pounds of commercial feed fed per milk cow; and, (3) multiplication of the average number of milk cows during the year in question by the average pounds of commercial feed fed to derive the tonnage of commercial feed.

Step one and two were done first to compute the average pounds of commercial feed fed, and then, that figure was multiplied by the average number of milk cows to determine the tonnage for any one year. In step two it was necessary to compute the basic data.

Tons of Commercial Feed Fed.--The tons of commercial feed fed is computed and shown in Table I.

Example computation for one year.--In 1962 there were 26,999 tons of commercial feed fed to milk cows in the eastern third of Kansas. Data used to arrive at this figure were: (1) concentrates, 2160 pounds per cow; (2) commercial feed percent, 14; and, (3) average number of milk cows, 178,800 head. Computation of the average pounds of commercial feed per cow was 302 pounds. This figure was determined by multiplying 14 percent by the 2160 pounds of concentrate fed. Multiplying the 302 pounds of commercial feed per cow by the average number of milk cows gives the tonnage of 26,999. The sequence for this procedure is shown in Table I.

Analysis of Computations.--In 1956, the amount of commercial feed fed was computed to be 24,507 tons. The amount fed increased to

TABLE 1

PROCEDURE I

COMPUTATION OF TONS OF COMMERCIAL FEED FED TO MILK COWS

Year	Pounds of Concentrate Fed Per Cow (1)	Percent Commercial Feed in the Concentrate Ration (2)	Pounds of Commercial Feed Per Cow (3)	Average Number of Milk Cows (4)	Total Computed Tons of Commercial Feed Fed (5)
1962	2160	14	302	178,800	26,999
1961	2070	16	331	185,000	30,618
1960	1960	14	274	185,200	25,372
1959	1750	11	192	208,850	20,050
1958	1670	14	234	217,050	25,390
1957	1740	13	226	231,200	26,126
1956	1640	12	197	248,800	24,507

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[a] United States Department of Agriculture, Agricultural Statistics, (Washington: U. S. Government Printing Office, 1957-1963).

[b] Kansas State Board of Agriculture, Kansas Farm Facts, (Topeka: State Printer, 1957-1963).

26,007 tons the next year followed by two years of sharp decrease. Again, in 1960 there was a sharp increase as the tons of commercial feed fed jumped by over 5,000 tons compared with 1959. The year 1961 was also a year of increase, however, it was followed by a year of sharp decrease.

The one characteristic of special note is the fluctuation in the tons of commercial feed fed between years. However, the average yearly increase has been about 600 tons per year for the seven year period when 1956 is compared with 1962.

The trend in number of milk cows is down. At first glance, these two trends would seem to offset the other; this, however, has not been the case. Over the seven year period, 1956-1962, milk cow numbers have decreased by 70,000 head or at the average rate of 10,000 head per year. However, the decrease in the number of milk cows has tended to level out in the last few years of the period.

The average feeding rate for commercial feed indicates an unsteady but upward trend. The low point in average pounds of commercial feed fed, was in 1959 when only 192 pounds were fed--compared with a high of 331 pounds in 1961. However, by using 1956 and 1962 feeding rates, an average yearly increase of 18 pounds of commercial feed fed per cow is apparent.

Projected Tonnage by 1970.--A least squares trend line was used to project the tonnage of commercial feed to 1970. The formula for the least squares trend line was $Y=a+bX$.[9] The trend line is based on the computed yearly tonnage of commercial feed fed to milk cows.

Analysis of Computed Projections.--The computed least squares trend line is shown in Chapter 6 page 44 with the actual computed feeding rates for the seven years. The projection of the tonnage of commercial feed is almost 32,122 tons or an average yearly increase over the 15 years of 258 tons of commercial feed.

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[9] Snedecor, p. 124.

CHAPTER IV

Procedure II

Introduction.--Procedure II involved using data on the average feeding rate of concentrates. The average pounds of commercial feed fed per cow was determined by applying a percentage figure times the average pounds of concentrate fed per cow. This procedure turned out to be the most time-consuming.

Explanation of the Data Used.--The data utilized to establish an average concentrate feeding rate comes from published sources based either on one or a combination of the following: (1) experiment station tests and recommendations; (2) experts' opinions; and, (3) published results of farmer surveys on feeding rates. An attempt was made to obtain every possible recommendation on the average feeding rate of concentrates. In many publications the feeding rate recommendations were set forward on the basis of an individual milk cow. In this circumstance, the feeding rate depended on the amount of milk and the butterfat content. This is the reason for the seemingly small number of entries in Table 2.

Explanation of the Procedure.--The data was arranged in order from lowest to highest in Table 2 for the average pounds of concentrate

TABLE 2

ARRAY OF RECOMMENDED FEEDING RATES OF CONCENTRATES TO MILK COWS

References	Recommended lbs. of Concentrate Per Milk Cow Per Year
1	1560
1	1760
2	2060
1	2250
2	2352
1	2538
2	2840
2	2961
2	2982
7	3033
3	3097
4	3262
6	3600
5	3720
5	5000

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[1] Lowell D. Hill and Carelton D. Dennis, *The Feed Manufacturing Industry and Michigan Agriculture* (East Lansing: Michigan Agricultural Experiment Station Special Bulletin No. 444, 1963), p. 15.

[2] F. B. Morrison, *Feeds and Feeding* (Ithaca: The Morrison Publishing Company, 1956), p. 648.

[3] K. T. Wright and T. L. Hodges, *Dairying for Profit in Southeastern Michigan* (East Lansing: Michigan Agricultural Experiment Station Special Bulletin No. 373, August, 1951), p. 31.

[4] George Dawson, *Economics of Dairy Farming* (State College: New Mexico Agricultural Experiment Station Bulletin No. 453, March, 1961), p. 1.

[5] *Costs and Returns From Dairy Cows* (St. Paul: Minnesota Agricultural Experiment Station Agricultural Economics Report No. 259, June 1, 1961) p. 28.

[6] C. R. Hoglund, *Economics of Dry-Lot Dairying in Michigan and California* (East Lansing: Michigan Agricultural Experiment Station Quarterly Bulletin, August, 1961), p. 136.

[7] James Mulvaney and R. G. Wheeler, *Feed Used on Grain-Livestock Farms in Southeastern Michigan* (East Lansing, Michigan Agricultural Experiment Station Quarterly Bulletin, May, 1959), p. 928.

fed per milk cow. There were fifteen separate entries of recommendations on the level of concentrates fed.

Two approaches were used to arrive at a figure that would represent an average of all the entries. The mean and median were used as estimates of the average feeding rates of concentrates from this array of recommendations.

The second feature of this procedure is the two levels of percent of commercial feed in the concentrate. There was no information on this figure in any publication except Agricultural Statistics, and that data was used as one level.[10] The second level comes from the survey of milk cow farmers in the eastern third of Kansas. The survey percent figure is shown in Table 6 on page 39.

Tons of Commercial Feed Fed.--There were several steps necessary for this procedure before the end product was reached. This is mainly because of the necessity of determining an average concentrate feeding rate and arriving at a percentage figure of commercial feed in the concentrate ration.

Average Feeding Rates of Concentrates.--Table 2 shows the listing of the various recommended concentrate feeding rates of milk cows. These entries are arranged in order from the lowest to highest which gives a difference of 3,440 pounds per milk cow.

It was first necessary to determine a figure which would be representative of the tabled data. The mean value was utilized for this purpose. The mean feeding rate was computed to be 2,868 pounds of concentrate per milk cow.

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[10] Agricultural Statistics, 1957-1963.

Computation of the median gives a somewhat different answer. This was done in Table 2 and the mid-point entry is 2,928 pounds of concentrate per milk cow or 60 pounds higher than the mean feeding rate.

Percent of Commercial Feed in the Ration.--A percentage figure is necessary in order to arrive at the average pounds of commercial feed in the ration. The level was used utilizing percentage figures from two sources.

The first level was determined by the percentage for commercial feed given in the Agricultural Statistics and used in Procedure I.[11] The computation of the average pounds of commercial feed fed per milk cow is calculated as 402 pounds. This figure was determined by multiplying the average pounds of concentrate per milk cow, which was 2,868 pounds, times the percent that commercial feed is of the total concentrate. This figure was 14 percent as shown in Table 1.

The second level was determined by the percentage figure for commercial feed in the concentrate ration from the results of the survey of farmers having milk cows. The percent commercial feed figure of 21 was multiplied by the mean average feeding rate of concentrates of 2,868 pounds per milk cow to obtain a figure of 602 pounds of commercial feed per milk cow.

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[11] Agricultural Statistics, 1957-1963.

The difference between these two levels is mainly the large difference in the estimated percent of commercial feed in the ration.

Tons of Commercial Feed Fed.--Tons of commercial feed fed to milk cows in the eastern third of Kansas were computed for the seven year period for the two levels of commercial feed percent in the concentrate ration. The results of the computations are given in Table 3.

Example Computation for One Year.--Several steps were necessary to arrive at the tons of commercial feed fed in 1962. These steps were completed for each level and there was no overlapping. Table 3 shows the steps involved in arriving at a final figure.

For Level One in 1962, there were 35,939 tons of commercial feed fed to milk cows. Data used in computing this tonnage were: (1) concentrates, 2,868 pounds per cow; (2) commercial feed percent, 14; and, (3) average number of milk cows, 178,800 head. Computing the average pounds of commercial feed per cow gives a figure of 402. This figure was determined by multiplying 14 percent times 2,868 pounds of concentrate fed. The tonnage was determined by multiplying 402 times the average number of milk cows which is 178,800.

The tonnage for Level Two is determined in the same manner. However, the average pounds of commercial feed per milk cow was higher and gave a tonnage of 53,819.

Analysis of Computation.--The tons of commercial feed fed for the two

TABLE 3

PROCEDURE II, COMPUTATION OF TONS OF COMMERCIAL FEED FED TO MILK COWS

Year and Level	Pounds of Concentrate Fed Per Cow	Computed Change in Concentrates Fed[a]			Computed Pounds of Concentrate Fed
		Present Year[b]	1962 Base	Computed Change	
1962	2868	set	set	1.000	2868
Level One					
Level Two					
1961	2868	2070	2160	.9583	2748
Level One					
Level Two					
1960	2868	1960	2160	.9074	2602
Level One					
Level Two					
1959	2868	1750	2160	.8102	2324
Level One					
Level Two					
1958	2868	1670	2160	.7731	2217
Level One					
Level Two					
1957	2868	1740	2160	.8056	2310
Level One					
Level Two					
1956	2868	1640	2160	.7592	2177
Level One					
Level Two					

[a] United States Department of Agriculture, Agricultural Statistics (Washington: U. S. Government Printing Office, 1957-1963).

[b] Pounds of Concentrate as published in the Agricultural Statistics and used to compute percent change in feeding rates of concentrates.

TABLE 3--Continued

1962 Pounds of Commercial Feed Fed Per Cow	Factor to Arrive at Pounds of Commercial Feed Per Cow	Computed Pounds of Commercial Feed Fed Per Cow
	1.000	
402		402
602		602
	1.096	
402		440
602		660
	.907	
402		364
602		546
	.636	
402		256
602		383
	.773	
402		310
602		466
	.748	
402		300
602		450
	.652	
402		261
602		392

TABLE 3--Continued

Average Number of Milk Cows on Farms During the Year[c]	Computed Pounds of Commercial Feed Fed	Computed Tons of Commercial Feed Fed
178,800	71,877,600	35,939
178,800	107,637,600	53,819
185,000	81,400,000	40,700
185,000	122,100,000	61,050
185,200	67,412,800	33,706
185,200	101,119,200	50,560
208,850	53,465,600	26,733
208,850	79,989,550	39,995
217,050	67,285,500	33,643
217,050	101,145,300	50,573
231,200	69,360,000	34,680
231,200	104,040,000	52,020
248,800	64,936,800	32,468
248,800	97,529,600	48,765

[c] Kansas State Board of Agriculture, Kansas Farm Facts, (Topeka: State Printer, 1957-1963).

levels is given in Table 3. The pattern of increase and decrease was the same for both levels because of the same decrease in concentrate feeding rates based on the data given in the Agricultural Statistics.[12]

It is readily evident that Level Two is much higher than Level One. In 1962 there was a difference of almost 18,000 tons of commercial feed fed. This great difference can be attributed entirely to the level of commercial feed in the concentrate fed to milk cows.

Projected Tonnage by 1970.--A least squares trend line was used to project the tonnage of commercial feed fed by 1970 for the two levels. The trend line is based on the computed yearly tonnage of commercial feed fed to milk cows for both levels. The results of the projection are shown in Graph 1 on page 44.

Analysis of Computed Projections.--The results of the computed projections are shown in Graph 1. As would be guessed from the results of the feeding rates discussed earlier, the greater tonnage would be for Level Two.

The projection of the tonnage of commercial feed by 1970 for Level One is 44,560 tons. Over the fifteen year period from 1956 to 1970 there should be an increase of 12,092 tons. This gives an average yearly increase of about 800 tons of commercial feed per year.

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[12] Agricultural Statistics, 1957-1963.

The projection of tonnage of commercial feed based on Level Two indicates that 64,160 tons will be fed. Comparing 1956 with 1970 this gives an increase of 15,395 tons or an average yearly increase of slightly over 1,000 tons per year over the fifteen year period.

CHAPTER V

Procedure III

Introduction.--Procedure III involved the most expense of the three procedures. A probability mail survey was utilized to obtain information on the rate which concentrates and commercial feeds were fed to milk cows.

Explanation of Data Used.--The survey results were used only to determine the average pounds of commercial feed and concentrates fed to milk cows. There was no attempt to arrive at a total figure of commercial feed fed by expanding the sample results to universe size. The average figure for commercial feed fed to milk cows from the survey was multiplied by the average number of milk cows. This was done because it provided a much simpler method with the same results.

Explanation of the Procedure.--Procedure III utilized two sets of data which were as follows: (1) the average pounds of concentrate fed per milk cow reported by farmers; and, (2) the average number of milk cows for each year in question. The answer was obtained by multiplying the pounds of concentrate fed by the number of milk cows to arrive at the tonnage for the year.

Survey Results.--The listing of sixty-four returns is shown in Table 4. The returns are listed on a farm basis and show the number of milk cows on the farm, the pounds of concentrate fed per cow and the pounds of

TABLE 4

LISTINGS OF RETURNS OF CONCENTRATE AND COMMERCIAL FEED FED TO MILK COWS, SURVEY OF KANSAS FARMS, 1963

Return Number	Number of Milk Cows	Concentrates		Commercial Feed	
		Pounds Per Cow	Total Pounds	Pounds Per Cow	Total Pounds
1	7	4,500	31,500	1,428	10,000
2	1	1,733	1,733	1,733	1,733
3	8	1,825	14,600	1,825	14,600
4	38	5,400	205,200	2,600	98,800
5	17	5,760	97,920	2,565	43,600
6	38	5,475	205,012	2,750	102,506
7	9	4,300	65,700	730	6,570
8	1	5,840	5,840	730	730
9	6	4,830	28,980	730	14,300
10	3	730	2,190	730	2,190
11	31	2,920	90,520	774	24,000
12	1	1,500	1,500	750	750
13	35	3,469	121,400	800	28,000
14	10	3,000	30,000	365	3,650
15	10	2,500	25,000	300	3,000
16	3	400	1,200	400	1,200
17	6	2,500	15,000	400	2,400
18	17	2,824	48,000	300	5,100
19	4	2,500	10,000	300	1,200
20	20	2,880	57,600	360	7,200
21	4	4,125	16,500	375	1,500
22	20	6,300	126,000	300	6,000
23	20	4,650	93,000	300	6,000
24	17	5,475	93,075	350	5,950
25	30	1,650	49,500	193	5,800
26	50	6,000	300,000	200	10,000
27	26	3,769	98,000	231	6,000
28	1	2,000	2,000		
29	1				
30	2	900	1,800		
31	7	2,555	17,885		
32	2	3,650	7,300		

TABLE 4--Continued

Return Number	Number of Milk Cows	Concentrates			
		Pounds Per Cow	Total Pounds	Pounds Per Cow	Total Pounds
33	1				
34	4				
35	15	1,800	22,000		
36	1				
37	1	400	400		
38	4				
39	10	1,825	18,250		
40	1	1,000	1,000		
41	80	500	40,000		
42	8	4,200	33,600	140	1,120
43	40	1,825	73,000		
44	2	60	120	60	120
45	1	1,200	1,200		
46	1	3,600	3,600		
47	6	2,800	16,800		
48	6	4,292	25,752		
49	5				
50	6				
51	15	2,190	32,850	110	1,650
52	15	5,475	82,125	548	8,030
53	45	3,920	176,400	533	24,000
54	3	500	1,500	500	1,500
55	1	3,500	3,500	500	500
56	8	3,200	25,600	480	3,840
57	4	1,000	4,000	500	2,000
58	18	2,800	50,400	444	8,000
59	30	1,800	54,000	600	18,000
60	28	3,714	104,000	1,114	31,200
61	20	3,000	60,000	1,000	20,000
62	[illegible]	3,000	150,000	1,000	50,000
63	16	2,500	40,000	1,000	16,000
64	30	5,840	150,000	1,278	38,340

commercial feed fed per milk cow as well as the total pounds of each type of feed fed per farm.

Average Number of Milk Cows Per Farm.--The average number of milk cows per farm in 1962 according to the survey return was 14.4. This figure was determined by dividing the number of useable reports, which was sixty-four, by the number of milk cows, which was 920.

Number of Milk Cows Fed Commercial Feed.--As Table 4 shows, the largest percentage of dairy farmers feed commercial feed to their milk cows. Twenty farmers reported they fed no commercial feed to milk cows during 1962 while forty-four reported they fed commercial feed to milk cows. This is 69 percent of the dairy farmers reporting some commercial feed to milk cows.

The estimate for the parameter of this sample would be computed as 69 percent. Confidence intervals based on 44 of the 64 dairy farmers reporting is given as follows:[13]

CI_{90} $57 \le p \le 76$

CI_{95} $55 \le p \le 79$

CI_{99} $51 \le p \le 82$

Thus, it can be said with the chance of being wrong one time out of ten, that the percent of farmers feeding commercial feed is from 57 to 76 percent not considering the sampling error due to non-response.

Thirty-one percent of the farmers reporting milk cows did not feed commercial feeds. However, this 31 percent accounted for only

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[13] Snedecor, p. 2.

21 percent of the milk cows reported. This comparison is shown in Table 4.

Dairy farmers having herds of more than fourteen cows per herd tended to feed a great deal more commercial feed than those dairy farmers which had fewer than fourteen cows. The larger than fourteen cow size herds received on the average 744 pounds of commercial feed per cow. This compared with the below fourteen size cow herd which had an average feeding rate for commercial feed of only 358 pounds. Twenty-one out of the thirty-eight dairy farmers with milk cow herds smaller than the sample average size did not feed commercial feeds, while only three out of the twenty-six in the larger than average group did not feed commercial feed.

Average Commercial Feeding Rate.--The average pounds of commercial feed fed per milk cow as computed from the listing of returns in Table 4 was 684 pounds per cow.

Tons of Commercial Feed Fed.--The tons of commercial feed fed for the seven year period are shown in Table 6. The table also points out the basic steps involved in arriving at the tonnage figure for any one year.

Example Computations for One Year.--In 1962 there were 61,150 tons of commercial feed fed to milk cows in the eastern third of Kansas. Data used to arrive at this figure was: (1) pounds of commercial feed fed to milk cows as determined by the survey which was 684 pounds; and, (2) the average number of milk cows which was 178,800 head. Multiplying the average pounds of commercial feed per cow times the 178,800 milk

TABLE 5

COMPARISON OF AVERAGE FEEDING RATES FOR MILK COWS

Less Than Average Size Return	Number of Cows	Feeding Rate	Total	Return	Larger Than Average Size Number of Cows	Feeding Rate	Total
8	4	500	2,000	1	17	2,565	43,605
13	6	0	0	2	18	444	7,992
14	5	0	0	3	26	231	6,006
15	6	0	0	4	50	200	10,000
17	6	0	0	5	38	2,600	98,800
18	4	0	0	6	38	2,750	104,500
19	1	0	0	7	15	110	1,650
20	1	0	0	9	17	350	5,950
21	2	0	0	10	35	800	28,000
24	8	1,825	14,600	11	20	300	6,000
25	8	140	1,120	12	30	1,278	38,340
26	8	480	3,840	16	20	300	6,000
28	4	300	1,200	22	40	0	0
29	1	500	500	23	20	360	7,200
31	1	0	0	27	30	193	5,790
32	3	500	1,500	30	80	0	0
34	10	0	0	33	17	300	5,100
35	4	0	0	37	16	1,000	16,000
36	1	750	750	41	30	600	18,000
38	7	1,428	9,996	44	15	0	0
39	1	0	0	46	31	774	23,994
40	6	400	2,400	51	45	533	23,985
42	3	400	1,200	52	50	1,000	50,000
43	1	0	0	55	20	1,000	20,000
45	4	0	0	56	28	1,114	31,192
47	3	730	2,190	63	15	548	8,220
48	1	0	0				
49	6	0	0				
50	2	0	0				
53	7	0	0				
54	2	0	0				
57	1	730	730				
58	10	300	3,000				

TABLE 5--Continued

Less Than Average Size				Larger Than Average Size			
Return	Number of Cows	Feeding Rate	Total	Return	Number of Cows	Feeding Rate	Total
59	1	1,733	1,733				
60	10	365	3,650				
61	1	0	0				
62	1	0	0				
64	9	730	6,570				
Total	159		56,979		761		566,324

cows gives a tonnage of 61,150.

Analysis of Computation.--The first item of importance from Table 6 is the great variation from year to year in the estimated tonnage of commercial feed fed. This is not true for all years; yet, the year to year change has been as great as 12,000 tons. However, within this pattern of variation, there is an observed upward trend.

The average yearly increase comparing tonnage in 1956 with 1962 is about 2,300 tons a year. This sharp increase appears to have occurred despite the fact that the number of milk cows has been decreasing at the average rate of 10,000 cows per year.

Projected Tonnage in 1970.--A least squares trend line was utilized to project the tonnage of commercial feed fed in the year 1970. The trend line is based on the computed yearly tonnages in Table 6.

Analysis of Computed Projection.--The computed least squares trend line with projection to 1970 is shown in Graph 1. The projection based on the computed tonnage for the seven years in 1970 is 72,260 tons of commercial feed. This projection gives an average yearly increase of about 1,200 tons per year over the 15 year period.

TABLE 6

TONNAGE OF COMMERCIAL FEEDS FED TO MILK COWS

Year	Present[a]	Base Year 1962	Computed Change	1962 Survey Pounds	Pounds of Commercial Feed Adjusted to Year in Question	Number of Milk Cows[b]	Total Commercial Feed
1962	302	302	1.000	684	684	178,800	61,150
1961	331	302	1.096	684	750	185,000	69,375
1960	274	302	.907	684	620	185,200	57,412
1959	192	302	.636	684	435	208,850	45,425
1958	234	302	.775	684	530	217,050	57,518
1957	226	302	.748	684	512	231,200	59,187
1956	197	302	.652	684	450	248,800	55,980

[a] United States Department of Agriculture, Agricultural Statistics (Washington: U. S. Government Printing Office, 1957-1963).

[b] Kansas State Board of Agriculture, Kansas Farm Facts (Topeka: State Printer, 1957-1963).

PART III. SUMMARY OF RESULTS AND CONCLUSIONS

CHAPTER VI

COMPARISON OF PROCEDURES AND CONCLUSION

Introduction.--This chapter brings together the three procedures and the results obtained on commercial feed fed from those procedures. The basic method of computation is the same for the three procedures, with the only difference being in the level for the amount of commercial feed fed to milk cows.

The data for the different procedures is presented in table and in graph form to show the observed wide differences in the projected tonnage. The similarity in the slope of the projection is because the years prior to 1962, for Procedures II and III, were estimated based on the data from Procedure I.

Average Feeding Rates for the Seven Years, 1956 to 1962.--Feeding rates of concentrates and commercial feeds vary a great deal from farm to farm depending on numerous factors. This paper is not concerned with the change that each variable may have on the total tonnage but rather, the general level of feeding rate, and the projection of the trend in tonnage into the future.

Tables.--The first means of illustrating the difference between the average feeding rates of commercial feed per milk cow is shown in Table 7. Procedure I has an average feeding rate of commercial feed per cow far below that for the other two procedures.

TABLE 7

COMPUTED AVERAGE POUNDS OF COMMERCIAL FEED FED TO MILK COWS, POUNDS PER COW

Years	Procedure I	Procedure II		Procedure III
		Level One	Level Two	
1956	197	261	392	450
1957	226	300	450	512
1958	234	310	466	530
1959	192	256	383	435
1960	274	364	546	620
1961	331	440	660	750
1962	302	402	602	684

The rate of feeding commercial feed as computed in Procedure I in 1962, was on the average of 302 pounds per milk cow. Average feeding rates for Level One in Procedure II is 402 and Level Two is 602 pounds. The average feeding rate for Procedure III is 684 pounds. These variations point out the differences in the projected tons of commercial feed.

Interval Estimates.--An interval estimate was utilized on the sample mean feeding rate of commercial feed to determine if the other computed commercial feeding rates fell within the confidence interval.

The sample means for Procedures I and II lie outside of the 99 percent confidence interval on the survey mean average feeding rate for 1962. It can be said with 99 percent confidence, not considering the sampling error due to non-response, that the average feeding rate of commercial feed to milk cows is in the range of from 619 to 749 pounds. However, it also means that there is one chance in a hundred that the true sample mean does not lie in this range.

Average Number of Milk Cows.--The average number of milk cows was the other variable for which a value must be determined. The same value was used for this variable in all three procedures.

It is generally considered that this data is reasonably accurate. It would be almost impossible for a firm to obtain an estimate of any greater accuracy. If an attempt to estimate numbers were made, it would be an extremely expensive proposition.

Tonnage of Commercial Feed Fed.--The two basic variables, average pounds of commercial feed fed to milk cows and the average number of milk cows for a certain time period, have been reviewed. The more accurate estimates obtained for these variables the more accurate will be the result.

Basic Computations.--The basic computations for each procedure are given in the respective chapters with a summary of results shown in Table 8. Each procedure varies somewhat from the other depending on the data available. A procedure was developed to compute feeding rates for Procedures II and III which assumed that the change for Procedure I was correct but the level was not.

Comparison of Projected Tonnage.--Projections based on the computed average feeding rates for the three procedures are shown in Graph I.

The projections are made on the basis of a least squares trend line through the computed tonnage for each of the seven years.

TABLE 8

ESTIMATED TONS OF COMMERCIAL FEED FED IN THE EASTERN THIRD OF KANSAS, 1956-1962

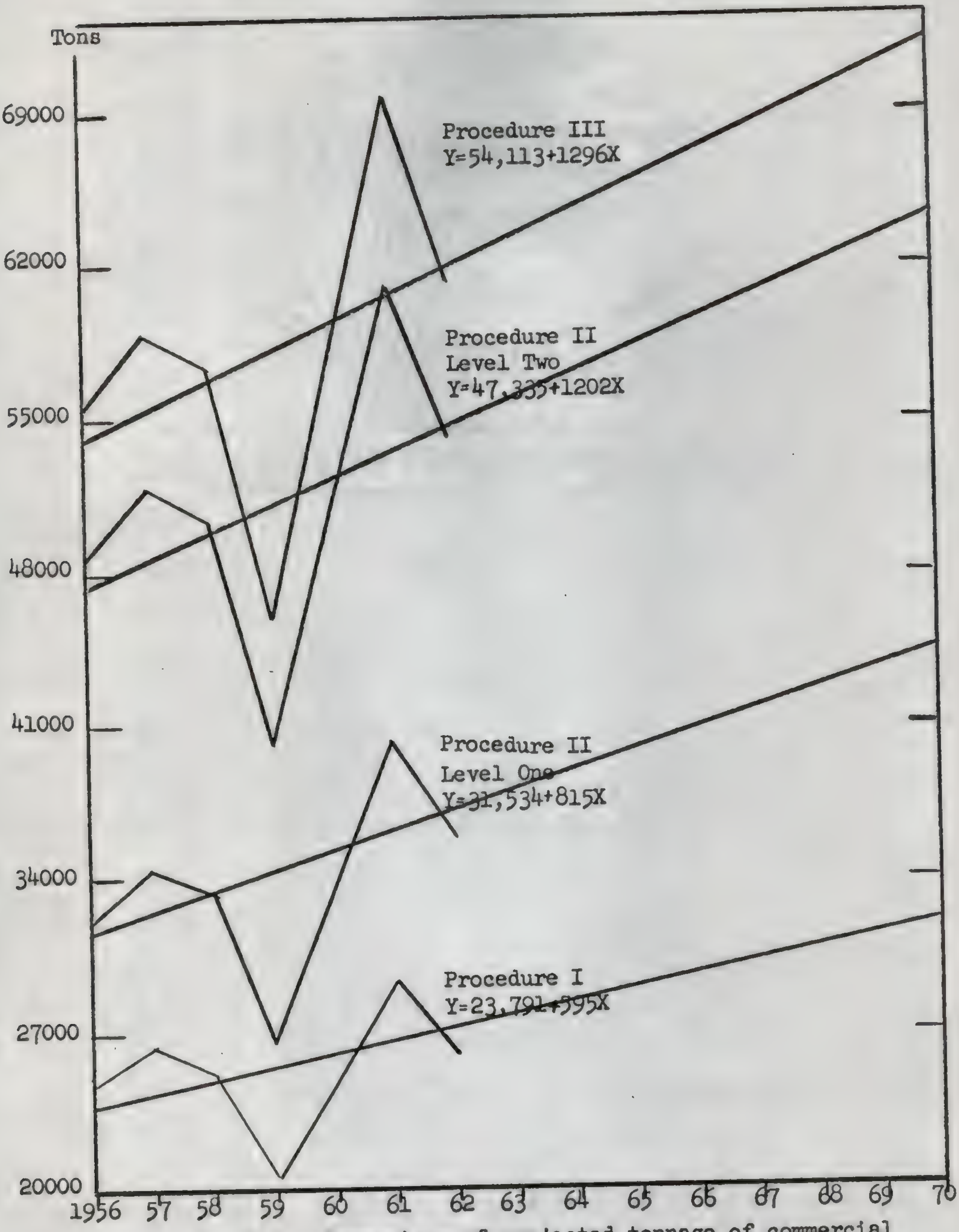
Year	Procedure I	Procedure II Level One	Procedure II Level Two	Procedure III
1956	24,507	32,468	48,765	55,980
1957	26,125	34,650	52,020	59,187
1958	25,390	33,643	50,573	57,518
1959	20,090	26,733	39,995	45,642
1960	25,372	33,706	50,560	57,412
1961	30,618	40,700	61,500	69,375
1962	26,999	35,939	53,819	61,190

Procedure III is much higher than the other two procedures. Projected tonnage for commercial feed in 1970 for Procedure III is 72,260 tons, 225 percent more than Procedure I, 162 percent more than Level One, Procedure II, and 113 percent more than Level Two.

Summary.--A study of this type brings to light many important factors influencing the tons of commercial feed fed. Perhaps the biggest factor is the estimate on the average pounds of commercial feed fed per milk cow.

Average Pounds of Commercial Feed Fed.--The average pounds of commercial feed fed varied a great deal. Since this is one of the two main variables in the equation the effect tends to be great.

Average Number of Milk Cows.--These data on milk cows were readily



Graph I.--Comparison of projected tonnage of commercial feed for the three procedures available for most states. Thus, the second part of the equation was more easily determined.

Definitions.--Definitions provide boundaries within which researchers can work. The type of market was defined as milk cows and the market potential as the amount of commercial feed the market can absorb.

Projections.--The projections utilizing a least squares trend line for the three procedures varied greatly. The market potential forecast based on the survey of dairy farmers was considerably above the other two procedures.

Evaluation of Procedures.--All three procedures rely on the amount of commercial feed fed to milk cows and the average number of milk cows for any one year. With the average number of milk cows relatively established, the crucial item becomes the rate of feeding commercial feeds.

The survey of Kansas farms would certainly lend support to a high rate of feeding both concentrates and commercial feed. The published data on feeding rates of concentrates would also support a high level. However, the difference between these two levels for feeding rates of commercial feed is quite substantial as shown in Table 8.

The data used in Procedure I for concentrates and commercial feeds, seems to be somewhat conservative.[14] This data has shown an increase over the 1956-1962 period but not at a very rapid rate.

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[14] *Agricultural Statistics*, 1957-1963.

There has been a definite change in dairy farming operations during the 1956-1962 period. It is no longer profitable to keep one or two cows to supply the household demand for milk and sell a little cream in town. Probably these one or two cows were low producers and were fed small amounts of concentrates and very little, if any, commercial feed.

The situation is now beginning to change. Dairy operations are becoming more specialized or entirely specialized. Some of these operators may buy most of their roughages and a great deal of their concentrates. The milk cows are not a sideline but the only source of income to the firm.

Under these conditions milk cows are generally higher producing animals and are fed more concentrates to utilize this higher production capacity.

In the last few years, there has been an increased emphasis on the importance of feeding more concentrates to milk cows. Possibly, this trend in thinking will further increase the amount of commercial feed fed.

It seems very possible that the feeding rate for commercial feed is somewhere near the survey average. However, this is not to say that this level should be accepted without further research.

Improvement of Data.--The data could be improved by taking a sample only of milk cow farms. This would allow for a larger number of farms to be sampled and further allow for a questionnaire exclusively pertaining to milk cows.

A follow-up is needed to eliminate the sample bias. A second and third request could be sent to farms not responding. After the second and third requests, a non-response interview could be utilized, though this method is very expensive.

Redesigning the questionnaire to eliminate reporter error as much as possible is needed also. The question on feeding rates should be asked for a specific day, preferably the previous day. This will help a great deal in reducing reporter error.

It would be necessary to do this survey every few months to determine the average yearly feeding rate. A group of dairy farmers selected at random to record daily the feeding rates of concentrates and commercial feeds would be a method to avoid taking a survey every month.

Conclusion.--The conclusion is that more information is needed on feeding rates. The information is needed for both feeding rates of commercial feeds and concentrates. Very little published information is available on feeding rates of either concentrates or commercial feed. The most specific information needed, of course, is that on commercial feeds, but the entire composition of the concentrate ration is also important.

The main reason for this conclusion is the great difference obtained in computed tonnage of commercial feed using the published and survey values. These great differences give little basis or solace to the feed manufacturing firms attempting to estimate market potentials.

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ESTIMATING THE MARKET POTENTIAL FOR COMMERCIAL FEEDS IN THE EASTERN THIRD OF KANSAS

by

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AN ABSTRACT OF A MASTER'S THESIS

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The purpose of this thesis was to establish a basic method of estimating the market potential for commercial feeds for milk cows in the eastern third of Kansas with the intention of determining the amount of difference caused by the various rates of feeding commercial feeds. The object of determining the difference caused by the various feeding rates was to point out the diverse market potentials obtained. The comparison was made using three procedures which differed almost solely in commercial feeding rates.

The basic formula for all three procedures was essentially the same. Slight differences were caused by the variation in the data available. Basically the computations involved multiplying the average pounds of commercial feed by the average number of milk cows on hand during the year. This computation gave the tons of commercial feed fed to milk cows during one year.

In Procedure I, published data on feeding rates of concentrates and commercial feed were utilized along with the average number of milk cows to arrive at the tons of commercial feed fed for the years 1956-1962. A least squares trend line was utilized to project the probable tonnage by the year 1970.

Procedure II differed from procedure I in two ways. The feeding rate for 1962 is based on a number of published concentrate feeding rates. The different rates were averaged to determine a concentrate feeding level. Then the percent of commercial feed in the concentrate ration as used in Procedure I and III were applied to compute levels 1 and 2 respectively. The change in feeding rates for the remaining 6 years was computed on the basis of the level of change in Procedure I.

In Procedure III information obtained from the survey of Kansas dairy farmers was utilized to compute the tons of commercial feed fed in 1962. Like Procedure II the change in the feeding rates for the remaining 6 years was computed on the basis of the level of change in Procedure I. A least squares trend line was used to project the tonnage of commercial feed expected to be fed in 1970.

A comparison of the projections for the three procedures showed a wide range in results. The conclusion was reached that more research is needed on feeding rates before accurate market potential estimates can be attained.

The material used in this thesis was taken from three sources. Farrell Library material was consulted for many of the references used. The survey of Kansas dairy farmers yielded information on feeding rates. The Kansas Crop Reporting Service made available unpublished information on extreme operators and gave permission to use the Kansas farm assessors books in drawing the sample.